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ABSTRACT

The occupational analysis contains a brief job description, presenting for the occupation of plumbing 12 detailed task statements which specify job duties (tools, equipment, materials, objects acted upon, performance knowledge, safety considerations/hazards, decisions, cues, and errors) and learning skills (science, mathematics/number systems, and communications). The 12 task statements cover the following performance duties: installing building sewer, installing building drains and storm sewers, installing and/or maintaining drain waste and vent systems, water supply systems, installing and/or maintaining domestic hot and cold water distribution systems, installing and/or maintaining gas and/or oil systems, installing and/or maintaining hydronic heating systems, installing and/or maintaining fire protection systems, installing and/or maintaining private sewer disposal systems, setting and/or repairing fixtures and fixture trim, and repairing plumbing fixtures and/or fixture trim. (JR)

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Occupational Analysis

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PLUMBING

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JUL 09 1975

Instructional Materials Laboratory
Trade and Industrial Education
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AN ANALYSIS OF THE PLUMBING OCCUPATION

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FOREWORD

The occupational analysis project was conducted by The Instructional Materials Laboratory, Trade and Industrial Education, The Ohio State University in conjunction with the State Department of Education, Division of Vocational Education pursuant to a grant from the U.S. Office of Education.

The Occupational Analysis project was proposed and conducted to train vocational educators in the techniques of making a comprehensive occupational analysis. Instructors were selected from Agriculture, Business, Distributive, Home Economics and Trade and Industrial Education to gain experience in developing analysis documents for sixty-one different occupations. Representatives from Business, Industry, Medicine, and Education were involved with the vocational instructors in conducting the analysis process.

The project was conducted in three phases. Phase one involved the planning and development of the project strategies. The analysis process was based on sound principles of learning and behavior. Phase two was the identification, selection and orientation of all participants. The training and workshop sessions constituted the third phase. Two-week workshops were held during which teams of vocational instructors conducted an analysis of the occupations in which they had employment experience. The instructors were assisted by both occupational consultants and subject matter specialists.

The project resulted in producing one hundred two trained vocational instructors capable of conducting and assisting in a comprehensive analysis of various occupations. Occupational analysis data were generated for sixty-one occupations. The analysis included a statement of the various tasks performed in each occupation. For each task the following items were identified: tools and equipment; procedural knowledge; safety knowledge; concepts and skills of mathematics, science and communication needed for successful performance in the occupation. The analysis data provided a basis for generating instructional materials, course outlines, student performance objectives, criterion measures as well as identifying specific supporting skills and knowledge in the academic subject areas.

PREFACE

This document represents a wide overview of the job of plumbing with related piping. Due to time limitation and the scope of the plumbing industry, much of the information is generalized. It was not the intent of the authors to be more specific. A reading of the area on Hydronic Heating should not be construed as being complete, but rather as an attempt by the authors to indicate some areas of hydronics that the plumber-mechanic often encounters.

The occupation of plumbing is becoming more sophisticated with each passing day. One only needs to understand the relationship between quality plumbing and its effect on environment, and the sophistication becomes self-evident. With the impact of environmental concerns, experienced in news and manifested in recently enacted legislation, the complexities of plumbing will become even greater.

In order to stay within the time alotted and still produce a valid analysis, the authors chose to examine plumbing on the basis of the primary systems that are encompassed by the occupation. Also, for validity, the author established empirical priority in the selection of systems to be analyzed.

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JOB DESCRIPTION *

The job description includes the practices and use of materials and fixtures used in the installation, maintenance, extension, and alteration of all piping, fixtures, appliances, and appurtanances in connection with any of the following: drainage systems, the venting systems and the water systems, within or adjacent to any building, structure, or conveyance; also the practice and materials used in the installation, maintenance, extension, and/or alteration of the storm-water, liquid waste, or drainage and water-supply system of any premises.

*Reference OBC; Chapter BB-51
ASA 40.8

Duty A Install Building Sewer

1 Check blueprints and drawings on job site
2 Determine invert of sewer depth/elevation
3 Open trench construction
4 Open trench construction for maintenance/repair
5 Shore trench construction for maintenance/repair
6 Lay clay pipe sewer
7 Install cleanouts vitrified clay pipe
8 Test sewer
9 Backfill construction for maintenance/repair
10 Locate sewer for maintenance/repair

(TASK STATEMENT) CHECK BLUEPRINTS AND DRAWINGS ON JOB SITE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Scale 100 foot tape Transit One set of blueprints Stake markers Hammers Target pole Marking caulk Graphic pad Pencil	Read and carefully examine architect's blueprints and specifications Inspect job site with blueprints Verify elevations Verify utility locations	Overhead power lines under ground utilities (''Bull in the pasture'')
DECISIONS	**CUES**	**ERRORS**
Make a closed survey	Discrepancy between the architect's print and the mechanical print Discrepancy between physical topography and architect's plot plans	Bidding error

(TASK STATEMENT) CHECK BLUEPRINTS AND DRAWINGS ON JOB SITE

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Measurement: geometric Linear, angle Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Basic Trigonometry Skills and Concepts (see appendix)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehend written instructions	Comprehension, Detail/Inference, Proposals, Terminology
Viewing	On site inspection	Visual analysis, Describing, Recognition of symbols, codes, emblems

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(TASK STATEMENT) DETERMINE INVERT OF SEWER DEPTH/ELEVATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pencil Transit Graphic pad Marking caulk Pick Shovel Target pole Flashlight Mirror	Remove manhole cover Extend target pole to bottom of inside of sewer Take reading with transit Record reading Replace cover	Allow time for manhole to ventilate Possible existance of noxious gases

DECISIONS	CUES	ERRORS
Determine if set-up is invert	Rod resting firmly on bottom of pipe Correct manhole	Possible in reading rod and/or recording in note book

(TASK STATEMENT) DETERMINE INVERT OF DEPTH/ELEVATION

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Measurement: geometric Linear, angle Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Basic Trigonometry Skills and Concepts **(see appendix)**

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading Writing Viewing	Comprehend written instructions Note taking On site inspection	Comprehension, Detail/Inference Spelling, Classification, Description Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

(TASK STATEMENT) OPEN TRENCH CONSTRUCTION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Shovel Pick Sledge hammer Air compressor Back-hoe Dump truck Front-end loader 100 foot tape Six foot rule Stakes Ditch jacks Hard wood Spud bar	Stake area Machine trench area Remove dirt Load truck Back fill Grade trench	Keep trench blocked off Light trench at night Barricade upon leaving Cave-in
DECISIONS	**CUES**	**ERRORS**
Determine the amount of earth to be removed Select type of shoring material	Types of soil	In determining types of soil or soil condition

(TASK STATEMENT) OPEN TRENCH CONSTRUCTION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Transfer of energy from one form to another Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area, volume Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Basic Geometry Skills and Concepts Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression
Listening	Receiving oral instructions	Concentration, Note taking, Detail/Inference
Viewing	On site inspection	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

(TASK STATEMENT) OPEN TRENCH CONSTRUCTION FOR MAINTENANCE/REPAIR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Sledge hammer Pick Shovel 100 foot tape Six foot rule Stakes Spud bar	Pick dirt loose Remove with shovel Back fill Grade ditch	Barricade ditch Cover securely Install lights Cave-in

DECISIONS	CUES	ERRORS
Ascertain where to open trench Determine depth of trench	Visable markers Utilities boxes and/or valves Intended use of trench	Damaged utility lines Improper location

(TASK STATEMENT) OPEN TRENCH CONSTRUCTION FOR MAINTENANCE/REPAIR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Transfer of energy from one form to another Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area, volume Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Basic Geometry Skills and Concepts Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression
Listening	Receiving oral instruction	Concentration, Note taking, Detail/Inference
Viewing	On site inspection	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

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(TASK STATEMENT) SHORE TRENCH CONSTRUCTION FOR MAINTENANCE/REPAIR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Saw Sledge hammer Nails Hardwood Six foot rule Air compressor Claw hammer Jacks Shovel Pick Spud bar	Position planks in trench Brace planks Crib openings for work area	Knotty wood Soft wood Dimension of wood Strength of wood used Keep shoring at bottom of trench Improper bracing Cave-in

DECISIONS	CUES	ERRORS
Determine size and type of shoring material	Shifting soil/sand/ground Water conditions	Improperly shored ditch

(TASK STATEMENT) SHORE TRENCH CONSTRUCTION FOR MAINTENANCE/REPAIR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Jack cribing into place] Fluids under pressure [Pile driver] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Strength of materials]	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Basic Arithmetic Skills and Concepts Ratio and proportion "Measure sense"/role of "unit" Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Oral instructions	Terminology, Clarity of expression
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Terminology
Writing	Written instructions	Spelling, Description, Terminology, Clarity of expression
Listening	Hearing instruction	Concentration, Note taking
Viewing	On site inspection	Describing, Detail/Inference, Recognition of symbols, codes, emblems

(TASK STATEMENT) LAY CLAY PIPE SEWER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Scraper Swab Trowel Level Rule Chisel Hammer Transit Target Pick Shovel Yarning iron Oakum Cement Sand Vitrified clay pipe Spud bar Staking material	Scribe circle on main Chisel out opening Insert slant Mix cement Seal slant Align and run pipe Stake and secure pipe	Cave-in

DECISIONS	CUES	ERRORS
Determine angle of insert	Depth of main sewer in relation to branch	Striking chisel too hard Cracked pipe Improper ''fall''

(TASK STATEMENT) LAY CLAY PIPE SEWER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Transfer of energy from one form to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Basic Arithmetic Skills and Concepts Ratio and proportion ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Oral instructions	Terminology, Clarity of expression
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Terminology
Writing	Written instructions	Spelling, Description, Terminology, Clarity of expression
Listening	Hearing instruction	Concentration, Note taking
Viewing	On site inspection	Describing, Detail/Inference, Recognition of symbols, codes, emblems

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(TASK STATEMENT) INSTALL CLEANOUTS VITRIFIED CLAY PIPE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Scrapper Swab Trowel Level Six foot rule Chisel Hammer Transit Target Pick Shovel Yarning irons Oakum Cement Sand Clay pipe Clay Y's Clay tee's Disc caps	Install ''Y's'' and/or tee's where required Install cleanouts ''Mark'' location of cleanouts	Gloves Scrapes Cuts

DECISIONS	CUES	ERRORS
Decide where to install cleanouts	Refer to local code Install within established dimensions	Improper location Lost time Increased cost

(TASK STATEMENT) INSTALL CLEANOUTS VITRIFIED CLAY PIPE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Jack cribing into place] Fluids under pressure [Pile driver] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Strength of materials]	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Basic Arithmetic Skills and Concepts Ratio and proportion ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Oral instructions	Terminology, Clarity of expression
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Terminology
Writing	Written instructions	Spelling, Description, Terminology, Clarity of expression
Listening	Hearing instruction	Concentration, Note taking
Viewing	On site inspection	Describing, Detail/Inference, Recognition of symbols, codes, emolems

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(TASK STATEMENT) TEST SEWER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Test plugs Water hose Stoppers Flash light Colored dye Mirror	Insert test plugs Mix dye Pour into sewer Observe at test tee Inspect each joint for possible leakage	

DECISIONS	CUES	ERRORS
Decide at what point to test	Refer to local code	Failure to secure code approval

(TASK STATEMENT) TEST SEWER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure	Basic Arithmetic Skills and Concepts (see appendix)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	On site inspection	Detail/Inference

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(TASK STATEMENT) BACKFILL CONSTRUCTION FOR MAINTENANCE/REPAIR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pick Shovel Back hoe Tamper-air Tamper-hand Front-end loader Dump truck Backfill material	Throw dirt back into trench Tamp to requirement Haul excess fill away Grade trench	Safety shoes Gloves

DECISIONS	CUES	ERRORS
Establish grade level	Contour of adjoining and/or established grade Local codes	Appearance of sloppy job Dissatisfied customer

(TASK STATEMENT) BACKFILL CONSTRUCTION FOR MAINTENANCE/REPAIR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure [Pile driver]	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area, volume Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Basic Geometry Skills and Concepts Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	On site inspection	Detail/inference
Reading	Comprehending written instructions	Comprehension/terminology

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(TASK STATEMENT) LOCATE SEWER FOR MAINTENANCE/REPAIR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Lot number Plot plan Blueprint Record measurements Pencil Graphic pad	Go to city hall or village hall or county engineer department Check record Get measurements ''Witching''	

DECISIONS	CUES	ERRORS
Determine where to find measurements ''Witching''	Plot plan Blueprints	Not recorded Erroneous entry

(TASK STATEMENT) LOCATE SEWER FOR MAINTENANCE/REPAIR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechaical advantage	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Examine prints	Comprehension, Detail/Inference, Terminology
Touching	''Witching''	E.S.P.

Duty B Install Building Drains and Storm

1 Compute fixture load on stack (construction and dwelling)
2 Size building drain
3 Connect soild stack to building drain
4 Extend building drain to building sewer
5 Install floor drains
6 Install cleanouts
7 Compute roof area drain
8 Install roof drains (construction of flat roof)
9 Clean blockage sewer repair
10 Repair broken building drain
11 Install down spouts

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(TASK STATEMENT) COMPUTE FIXTURE LOAD ON STACK (CONSTRUCTION AND DWELLING)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pencil Pad Blueprint and/or drawing Local code books	Check schematic drawing Count the number of fixtures Check special fixtures Total fixture unit	

DECISIONS	CUES	ERRORS
Determine fixture load	Check local code Manufacturer's specifications	Improper pipe sizing

(TASK STATEMENT) COMPUTE FIXTURE LOAD ON STACK (CONSTRUCTION AND DWELLING)

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Basic Arithmetic Skills and Concepts Ratio and proportion, Guess and check method, Rule of thumb ''Measure sense''/role of ''unit'' Instruments Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints [Fixture load tables]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprints	Comprehension, Detail/Inference, Description of mechanism, Terminology
Viewing	Blueprints/manufactuer's specifications	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

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(TASK STATEMENT) SIZE BUILDING DRAIN

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pencil Pad Blueprint and/or drawing Scale Local code books	Compute stack size Compute area drains Compute roof area Total all area to be drained	

DECISIONS	CUES	ERRORS
Determine drain size	Size of main Terminal points Local codes	Drain inadequate for building

(TASK STATEMENT) SIZE BUILDING DRAIN

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Basic Arithmetic Skills and Concepts Ratio and proportion, Guess and check method, Rule of thumb "Measure sense"/role of "unit" Instruments Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints [Fixture load tables]

COMMUNICATIONS		
PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprints/Local codes	Comprehension, Detail/Inference, Description of mechanism, Terminology
Viewing	Blueprints	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

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(TASK STATEMENT) CONNECT SOIL STACK TO BUILDING DRAIN

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Caulking irons Yarning irons Ball peen hammer Joint runner Lead Oakum Ladles Furnace Lead pot Chisels Soil pipe cutters Rule Pipe and fittings	Remove test plugs Install quarter bend/comb y and 1/8 bend Seal pipe Back fill Build piers for support	Safety glasses Gloves Hard hats Burns
DECISIONS	**CUES**	**ERRORS**
Choose stack-base fitting	Local code	Failure to comply with code

(TASK STATEMENT) CONNECT SOIL STACK TO BUILDING DRAIN

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure [Gas under pressure]	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Examine joints	Visual analysis, describing, detail/inference, recognition of symbols, codes, and emblems
Reading	Reading local codes	Comprehension, detail/inference, description of mechanism, terminology

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(TASK STATEMENT) EXTEND BUILDING DRAIN TO BUILDING SEWER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pick Shovel Level Transit Caulking iron Yarning iron Lead Oakum Lead pot Joint runner Ball peen hammer Furnace Soil pipe cutters Chisels Heavy hammer Target pole	Grade ditch to building sewer Lay pipe Seal joints Backfill	Hard hat Gloves Safety glasses Safety shoes Burns

DECISIONS	CUES	ERRORS
Determine depth under finished floor	Foundation wall Footer depth Sleeves	Sleeves not installed

(TASK STATEMENT) EXTEND BUILDING DRAIN TO BUILDING SEWER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Level	Visual analysis, detail inference

(TASK STATEMENT) INSTALL FLOOR DRAINS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Lead pot Oakum Lead Yarning irons Caulking irons Target Transit Level Six foot rule Pick Shovel Ball peen hammer Furnace Soil pipe cutters Chisels	Establish finished floor level Determine depth to trap Extend pipe from trap to floor line Set strainer	Hard hat Safety shoes Safety glasses Sewer gas Explosions

DECISIONS	CUES	ERRORS
Decide number and location of floor drains	Area to be drained Local codes	Fail to vent Seal trap seal with non-freezing liquid Loss of trap seal

(TASK STATEMENT) INSTALL FLOOR DRAINS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Level, rule	Visual analysis, detail inference

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(TASK STATEMENT) INSTALL CLEANOUTS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Six foot rule Pipe wrenches Lead Oakum Yarning irons Lead pot Caulking irons Level Furnace Pipe cutters Chisel Ball peen hammer	Insert cleanout fitting Seal joint Tighten cleanout plug or cap	Gloves Hard hat Safety glasses Safety shoes Burns

DECISIONS	CUES	ERRORS
Determine where cleanouts are required	Local city code and/or state code	Failure to meet code requirements

(TASK STATEMENT) INSTALL CLEANOUTS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Inspect installation	Visual analysis, detail inference

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(TASK STATEMENT) COMPUTE ROOF AREA DRAIN

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
100 foot tape Six foot rule Pad Pencil Drawing and/or blueprint	Measure length and width of area Check tables Use formula	Hard hat

DECISIONS	CUES	ERRORS
Determine where to install drain	Local code Structure design	Insufficient drainage

(TASK STATEMENT) COMPUTE ROOF AREA DRAIN

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area, volume Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprints	Detail/Inference, Description of mechanism

(TASK STATEMENT) INSTALL ROOF DRAINS (CONSTRUCTION OF FLAT ROOF)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Boxend wrenches Channel locks Chisel Ball peen hammer Claw hammer Roofing nails Pipe rest and/or champ-hanger Lead Oakum Leadpot Caulking irons Yarning irons Furnace Ladles Sheet lead Roof drains	Insert sheet lead in hub Caulk roof terminal strainer into hub Install pipe clamps Secure sheet lead Test for leaks	Hard hat Gloves Safety glasses Burns Falling off roof

DECISIONS	CUES	ERRORS
Determine number to be installed	Local code where required Roof construction	Code not met Roof leaks around drains

(TASK STATEMENT) INSTALL ROOF DRAINS (CONSTRUCTION FLAT ROOF)

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manufacturer's Roughin sheet	Comprehension, Detail/Inference, Description of mechanism

(TASK STATEMENT) CLEAR BLOCKAGE SEWER REPAIR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Sewer machine Sewer cables Pick Shovel Sledge hammer Wrenches Probing rod Pench bar Chisel	Remove cleanout plug Remove cleanout cap Break opening in pipe Insert rod Clear blockage Replace or repair broken sewer	Gloves Safety glasses Safety shoes

DECISIONS	CUES	ERRORS
Decide where to open sewer	Location on drawings Test tee Water service	Lost time Increase costs

(TASK STATEMENT) CLEAR BLOCKAGE SEWER REPAIR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Deliver oral instructions	Terminology, Diction, Clarity of expression [Demonstrations]

(TASK STATEMENT) REPAIR BROKEN BUILDING DRAIN

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pick Shovel Lead pot Caulking irons Yarning irons Lead Oakum Joint runner Ball peen hammer Level Six foot rule Pipe and/or fittings	Expose broken section Remove broken pipe Remove two additional joints Replace with new pipe Pour and caulk joints Test repair for leaks	Gloves Safety glasses Safety shoes Hard hat Burns

DECISIONS	CUES	ERRORS
Determine whether to repair or completely replace damaged/ defective area	Water or dampness in area of building drain Visible breaks in piping	Failure to effect repair

(TASK STATEMENT) REPAIR BROKEN BUILDING DRAIN

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Deliver oral instructions	Terminology, Diction, Clarity of expression [Demonstrations]
Viewing	Inspect drain	Visual analysis

(TASK STATEMENT) INSTALL DOWN SPOUTS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Level Six foot rule Furnace Lead Lead pot Oakum Caulking irons Yarning irons Pick Shovel Ball peen hammer Pipe cutters Cast iron traps Vitrified traps Vitrified pipe Swab Cement Sand Trowel Pipe	Connect traps to storm drain or combination storm and sanitary Extend pipe above grade level Seal joints	Hard hat Safety shoes Safety glasses Burns Cave-in

DECISIONS	CUES	ERRORS
Determine number to install	Local code Drawings/blueprints	Wrong locations

(TASK STATEMENT) INSTALL DOWN SPOUTS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Deliver oral intructions	Terminology, Diction, Clarity of expression [Demonstration]

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Duty C Install and/or Maintain Drain Waste and Vent Systems

1 Examine prints and specifications (construction of large buildings)
2 Take-off for bid preparation
3 Order materials (construction of large buildings)
4 Establish security for tools, equipment and materials (construction of large buildings)
5 Determine openings and elevations (construction of large building)
6 Fabricate and install piping (construction of large building)
7 Cap off/top-out (construction of large building)
8 Inspect final installation
9 Make drawing (repair/remodel)
10 Order and pick-up materials (repair/remodel)
11 Cut openings (repair/remodel)
12 Inspect final installation (repair/remodel)

(TASK STATEMENT) EXAMINE PRINTS AND SPECIFICATIONS (CONSTRUCTION OF LARGE BUILDINGS)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Scale Pencil Pad Blueprint Set of specifications	Check site Check utilities Check soil condition	

DECISIONS	CUES	ERRORS
Determine whether to bid or not to bid	Work v. dollars Existing work schedule v. manpower	Losses from bidding errors

(TASK STATEMENT) EXAMINE PRINTS AND SPECIFICATIONS (CONSTRUCTION OF LARGE BUILDINGS)

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Proposals, Description of mechanism
Viewing	Examine prints/specs	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems [Note taking]

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(TASK STATEMENT) TAKE-OFF FOR BID PREPARATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Material catalog Fixture catalog Price book Scale Take-off sheets Blueprints Specifications	Compute excavation and back fill List all materials needed Price materials Direct quote from manufacturer Submit bid	

DECISIONS	CUES	ERRORS
Determine contract price: to sign or not to sign	Specifications Comparison with prior work of similar construction	Losses due to careless or "hurried" take-off

(TASK STATEMENT) TAKE-OFF FOR BID PREPARATION

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehension of written instructions	Comprehension, Detail/Inference, **Recommendation reports, Proposals,** Description of mechanism
Viewing	**Examine prints/specifications**	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems [Note taking]

(TASK STATEMENT) ORDER MATERIALS (CONSTRUCTION OF LARGE BUILDING)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Manufacturer's catalog and price book Plumbing supply catalog and price book Take-off sheets	Shop by phone Select materials personally Prepare storage for materials on job site Have materials delivered Secure material	

DECISIONS	CUES	ERRORS
Determine sources of material Determine where and how to store and secure material	Price of materials Deliver schedule	Too much materials Inferior materials Failure to meet contract time Loss of materials

(TASK STATEMENT) ORDER MATERIALS (CONSTRUCTION OF LARGE BUILDING)

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Counting] Fundamental Operations (Calculation) Use of Numbers (without calculation) Counting

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Persuasion and Sales technique
Writing	Written instructions	Penmanship, Spelling, Classification, Description, Terminology, Clarity of expression

(TASK STATEMENT) ESTABLISH SECURITY FOR TOOLS, EQUIPMENT AND MATERIALS (CONSTRUCTION OF LARGE BUILDINGS)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Trailer Tool boxes Locks Tool sheds	Have tool shed moved to job site Build tool shed Lock tool boxes Fence in job site	

DECISIONS	CUES	ERRORS
Determine extent of security needed	Guard on duty Job location	Loss of materials

(TASK STATEMENT) ESTABLISH SECURITY FOR TOOLS, EQUIPMENT AND MATERIALS (CONSTRUCTION OF LARGE BUILDINGS)

SCIENCE	MATH – NUMBER SYSTEMS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Persuasion and Sales techniques
Writing	Written instructions	Penmanship, Spelling, Classification, Description, Terminology, Clarity of expression

(TASK STATEMENT) DETERMINE OPENINGS AND ELEVATIONS (CONSTRUCTION OF LARGE BUILDING)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe cutter Chisel Hammers Wrenches Transit and target Six foot rule Marking caulk Pencil Pad Sleeve materials	Establish finish floor lines Determine foot of elevations Cut chassis Insert sleeves	Safety glasses Safety shoes Hard hat Cuts

DECISIONS	CUES	ERRORS
Determine finish floor lines	Blueprints	Improper installation

(TASK STATEMENT) DETERMINE OPENINGS AND ELEVATIONS (CONSTRUCTION OF LARGE BUILDINGS)

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Looking at wall	Visual analysis, Describing, Detail/ Inference

(TASK STATEMENT) FABRICATE AND INSTALL PIPING (CONSTRUCTION OF LARGE BUILDING)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe threading machine Pipe wrenches Reamer Dies Pipe cutters Pipe and fittings [Steel, galvanized] Pipe cast iron and fittings Furnace Lead pot Oakum Lead Joint runner Ball peen hammer Caulking iron Yarning irons Six foot rule Soldering tools and equipment	Set a stack base fitting and/or build pier Fabricate soil pipe Cut and thread vents and waste pipes	Safety glasses Rails on scaffolding Safety shoes Gloves Hard hat Burns

DECISIONS	CUES	ERRORS
Determine types of vents to use Determine size of waste Determine developed length	Local code Blueprints	Replacement time/cost

(TASK STATEMENT) FABRICATE AND INSTALL PIPING (CONSTRUCTION OF LARGE BUILDINGS)

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on state of matter Fluids under pressure Transfer of heat from one body to another Effects of friction on work processes and product quality Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Parallel, perpendicular Understanding and use of the Pythagorean theorem, based on the right triangle ($a^2 + b^2 = c^2$) Basic Trigonometry Skills and Concepts **(see appendix)**

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression
Reading	Work with isometric drawings	Comprehension, Detail/Inference, Description of mechanism
Listening	Receiving oral instructions	Concentration, Note taking

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(TASK STATEMENT) CAP OFF/TOP-OUT (CONSTRUCTION OF LARGE BUILDING)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe threading machine Pipe wrenches Pipe compound Reamer Dies Pipe cutters Sheet lead and/or roof flashing Pipe and fittings Cast iron pipe and fittings Lead Lead pot Oakum Joint runner Ball peen hammer Caulking irons Yarning irons Six foot rule Roofing cement	Drop plumb line Scribe opening and install sleeves Assemble pipe **Install roof terminal** **Set flashing** **Seal flashing**	Safety glasses Safety shoes Hard hat Rails on scaffolding Gloves Burns

DECISIONS	CUES	ERRORS
Determine type of flashing to be used, e.g., pitch, straight, high boot, low boot, etc. **Determine type of sealing material**	Local code **Roof construction**	**Leak around flashing**

(TASK STATEMENT) CAP OFF/TOP-OUT (CONSTRUCTION OF LARGE BUILDING)

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on state of matter Fluids under pressure Centrifugal forces developed by bodies in rotation Transfer of heat from one body to another Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Recognize and identify basic geometry figures, plane and solid Determination of area and circumference of circles Basic Trigonometry Skills and Concepts (see appendix)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression
Reading	Drawing and prints	Comprehension, Detail/Inference, Recommendation reports
Listening	Receiving oral instructions	Concentration, Note taking
Viewing	On site inspection	Visual analysis, Describing, Detail/Inference
Touching		Size, shape

(TASK STATEMENT) INSPECT FINAL INSTALLATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Test plugs Wye plugs Caps Water hose Valves Pipe wrenches Small hand tools	Cap off all openings Insert test plugs Connect water hose Fill stack Check for leaks Seal leaks Call for inspection	Hard hat Safety shoes
DECISIONS	**CUES**	**ERRORS**
Determine location of leaks	Water level drops in stack	Leaks, cracked fittings, sand holes

(TASK STATEMENT) INSPECT FINAL INSTALLATION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression
Reading	Drawing and prints	Comprehension, Detail/Inference, Recommendation reports
Listening	Receiving oral instructions	Concentration, Note taking
Viewing	On site inspection	Visual analysis, Describing, Detail/ Inference
Touching		Size, shape

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(TASK STATEMENT) MAKE DRAWING (REPAIR/REMODEL)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Drawing paper Pencil 100 foot tape Six foot rule Drawing board Triangles T-Square Scale	Measure area to be drawn Locate fixtures Draw in fixtures Check drawing Get drawing approved	

DECISIONS	CUES	ERRORS
Select a location of fixtures	Local code	Dimensions off/inefficient use of space

(TASK STATEMENT) MAKE DRAWING (REPAIR/REMODEL)

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression
Reading	Drawing and prints	Comprehension, Detail/Inference, Recommendation reports
Listening	Receiving oral instructions	Concentration, Note taking
Viewing	On site inspection	Visual analysis, Describing, Detail/Inference
Touching		Size, shape

(TASK STATEMENT) ORDER AND PICK-UP MATERIALS (REPAIR/REMODEL)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Truck Material list	List materials Call in order Pick-up order	Driving safety

DECISIONS	CUES	ERRORS
Determine kind of materials needed	Customer select fixture	Fixtures not in stock - delays

(TASK STATEMENT) ORDER AND PICK-UP MATERIALS (REPAIR/REMODEL)

SCIENCE	MATH – NUMBER SYSTEMS
	Set of Real Numbers [Counting] Fundamental Operations Use of Numbers (without calculation) Counting

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Persuasion

(TASK STATEMENT) CUT OPENINGS (REPAIR/REMODEL)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Six foot rule Saws Hammer Wrenches Keyhole saw Sawzall Drills Plumb bob Small hand tools	Check drawing Mark and layout holes to be cut Cut openings Run pipes through openings Set/replace fixtures	Gloves Safety glasses Cuts

DECISIONS	CUES	ERRORS
Analyze structure of house Select proper tool	Joist locations Basic construction material of structure	Structure damage

(TASK STATEMENT) CUT OPENINGS (REPAIR/REMODEL)

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Centrifugal forces developed by bodies in rotation Transfer of energy from one form to another Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Strength of materials]	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Determination of area and circumference of circles

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Gestures
Listening	Receiving oral instructions	Concentration, Logic, Note taking
Viewing	On site inspection	Describing, Detail/Inference
Touching	Cutting holes	Size, shape

(TASK STATEMENT) INSPECT FINAL INSTALLATION (REPAIR/REMODEL)

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Air pump Gauges Test plugs Caps Valves Water hose Wrenches Small hand tools	Cap off all openings Insert test plugs Fill with water Call for inspection Remove plugs Set fixtures Attach air machine Watch pressure gauge Remove gauges and set fixtures	Safety shoes Safety glasses Gloves
DECISIONS	**CUES**	**ERRORS**
Determine type of test to use	Occupied or unoccupied dwelling	Water damage

(TASK STATEMENT) INSPECT FINAL INSTALLATION (REPAIR/REMODEL)

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression
Reading	Drawing and prints	Comprehension, Detail/Inference, Recommendation reports
Listening	Receiving oral instructions	Concentration, Note taking
Viewing	On site inspection	Visual analysis, Describing, Detail/ Inference
Touching		Size, shape

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Duty D Water Supply Systems

1 Establish source of water supply (construction of large building)
2 Size water supply
3 Establish protection of water supply systems
4 Excavate for water supply systems
5 Install water pipe from curb stop to meter
6 Repair burst water service
7 Thaw frozen water lines
8 Repair water well pumps

(TASK STATEMENT) ESTABLISH SOURCE OF WATER SUPPLY (CONSTRUCTION OF LARGE BUILDING) 81

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pencil Labels Jug Hose Water well drilling equipment Water well pumps	Use testing lab Check utilities department Check county engineers Install gravity tanks Install pressure tanks Install pumps water	Impure water Illness

DECISIONS	CUES	ERRORS
Determine amount of water needed Determine source of supply	City water system Streams Extended system	Inadequate supply of potable water

(TASK STATEMENT) ESTABLISH SOURCE OF WATER SUPPLY (CONSTRUCTION OF LARGE BUILDING)

SCIENCE	MATH – NUMBER SYSTEMS
Chemistry Biology Work input, work output, friction and efficiency in simple machines	Set of Real Numbers [Positive] Fundamental Operations ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Denotation/Connotation
Listening	Receiving oral instructions	Concentration, Logic, Note taking
Reading	Plans/drawings	Comprehension, Detail/Inference, Recommendation reports

(TASK STATEMENT) SIZE WATER SUPPLY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Charts Formulas Pencil Paper	Determine the number of people to serve Figure the amount of water for each person	Amoebic dysentary

DECISIONS	CUES	ERRORS
Determine number of gallons to store Determine types of pumps Determine type of storage tanks	Type of building Use of building Number of people	Cross connections

(TASK STATEMENT) SIZE WATER SUPPLY

SCIENCE	MATH – NUMBER SYSTEMS
Fluids under pressure Inertia and momentum Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Use of Numbers (without calculation) Coding [as per schematic] Ratio Ratio and proportion Guess and check method Rule of thumb Rate Measurement: geometric Linear, Pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints [Static head chart and other performance charts] Basic Arithmetic Skills and Concepts Finding a percent of a number and what percent one number is of another Fundamental Operations (see appendix)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference
Writing	Making schematic drawing	Penmanship, Spelling, Classification, Description, Terminology, Clarity of expression
Viewing	Analyze drawing	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

(TASK STATEMENT) ESTABLISH PROTECTION OF WATER SUPPLY SYSTEMS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Fence material Post Post hole digger Hammer and nails Sheeting **Back flow preventors** Insulation	Cover well Fence in pond or lake Cover tanks Screen over open tanks Cover with cement	Contaminated water Typhoid fever Paratyphoid fever Bacillary Hepatitis Poliomyelitis

DECISIONS	CUES	ERRORS
Determine type of covering materials	Type of container	**Polluted water**

(TASK STATEMENT) ESTABLISH PROTECTION OF WATER SUPPLY SYSTEMS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Effect of heating and cooling on expansion of materials Differences in absorption and radiation of energy between dark rough surfaces and light, smooth, polished surfaces	Set of Real Numbers [Positive] Fundamental Operations ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Touching	Protection of pipe	Size, shape, temperature, motion

(TASK STATEMENT) EXCAVATE FOR WATER SUPPLY SYSTEMS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Back hoe Drilling equipment Picks and shovels	Lay out area to excavate Have machine dig to desired depth Drill well to water Pipe water to locations Cover source of supply	Water borne diseases

DECISIONS	CUES	ERRORS
Decide pipe sizes Decide area of pond	Presence of water Potable water	No water or poor water

(TASK STATEMENT) EXCAVATE FOR WATER SUPPLY SYSTEMS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Centrifugal forces developed by bodies in rotation Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Gestures
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports

(TASK STATEMENT) INSTALL WATER PIPE FROM CURB STOP TO METER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pick and shovel Back hoe Copper pipe Flaring tools Hammer Shoring material	Determine location of curb lock Excavate curb lock Open trench to building Install water main Have inspection Back fill	Hard hats Cave-in

DECISIONS	CUES	ERRORS
Determine size of service line Determine type of piping material	Utilities department measurements Code	Erroneous entry

(TASK STATEMENT) INSTALL WATER PIPE FROM CURB STOP TO METER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Centrifugal forces developed by bodies in rotation Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Gestures
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports

(TASK STATEMENT) REPAIR BURST WATER SERVICE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Water pump Pick and shovel Street key Replacement pipe Valves Fittings Pipe pushing machine Pushing rods Ultra-sonic leak detector	Inter street into curb box shut off water from mains Excavate and remove box Set pipe pushing machine in basement Push rods out Pump out all water from trench Connect replacement pipe to rods Sack rods and pipe back into house Make inside and outside connection Check for leaks Obtain inspection	Hard hats Cave-in

DECISIONS	CUES	ERRORS
Decide type of pipe for replacement	Local code	Code not met

(TASK STATEMENT) REPAIR BURST WATER SERVICE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure Transfer of energy from one form to another Effects of friction on work processes and product quality Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Gestures
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports
Viewing	Examination of pipe	Describing, Detail/Inference

(TASK STATEMENT) THAW FROZEN WATER LINES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Electric thawing machine Steam machine Prestolite tank	Locate point where frozen Determine type of material and joints Apply thawing device	Maintaining equipment Burns Ground and electric shock
DECISIONS Choose equipment to use	**CUES** Type of materials	**ERRORS** Leaks/damage to joints

(TASK STATEMENT) THAW FROZEN WATER LINES

SCIENCE	MATH – NUMBER SYSTEMS
Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Effect of heating and cooling on state of matter Fluids under pressure Transfer of energy from one form to another Transfer of heat from one body to another Resistance of materials to flow of electrical current	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Delivering oral instructions	Terminology, Diction, Clarity of expression, Denotation/Connotation

(TASK STATEMENT) REPAIR WATER WELL PUMPS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Voltmeter Ohm meter Pressure gauges Side cutters Screwdrivers Pipe wrench Needle nose Socket set	Check electrical power source Check water level in well Disconnect power Remove pump Disassemble pump Make necessary repairs Reinstall pump Test pump under working conditions	Shock

DECISIONS	CUES	ERRORS
Determine exact malfunction	Pump not running Motor over heats Short cycling Continuous running Insufficient capacity No water Motor running	Failure to effect repair

(TASK STATEMENT) REPAIR WATER WELL PUMPS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Magnetic fields of force	''Measure sense''/role of ''unit'' Instruments [Volt/Ohm meter] Measurement: non-geometric Weight, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

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Duty E Install and/or Maintain Domestic Hot and Cold Water Distribution Systems

1 Adequately size the water distribution system
2 Install an overhead gravity feed system
3 Install up-feed system
4 Install a circulating water system
5 Construct a pressure reducing station
6 Install automatic domestic water heater
7 Install commercial water heating and hot water storage equipment
8 Repair circulating pump
9 Repair leak in domestic (house) water lines
10 Troubleshoot electric water heater
11 Troubleshoot gas water heater

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(TASK STATEMENT) ADEQUATELY SIZE THE WATER DISTRIBUTION SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	PERFORMANCE KNOWLEDGE (CON'T)
Isometric paper Pencil (with eraser) Scale Manufacturer's equipment data Local code book Pipe flow-rate tables Blueprints and/or building drawing Local water department regulations	Draw a schematic of water system, show all fixtures supplies and risers by means of appropriate letters and numbers. Indicate each floor elevation and the highest (furthest) water outlet to be supplied For pressure or gravity supply tank systems, show minimum water level at which tank is designed to operate at peak demand Indicate the minimum pressure required for satisfactory operation at the highest (furthest) water outlet and minimum pressure available at all times at the source Mark on the drawing the total load in terms of water supply fixture units (Note: fixtures having both hot and cold water outlets should be taken as ¾ of list unit value for said fixture) Mark on the drawing adjacent to all	fixture notations, the demand for each in g.p.m. (Note: indicate those fixtures of continuous use, e.g. irrigating equipment, AC equipment, and add them to the other fixtures) Assume condition of noflow - refer to third step - the difference from the third step will establish hints for friction losses Determine the basic circuit (Note: this will be longest developed length of pipe) Mark on drawings pressure loss due to equipment, e.g. meters, softners, etc Subtract eighth step from sixth, this will give the pressure available for basic circuit Calculate pipe lengths and add 50% for fittings and valves Use sizing tables, check flow rates of various sizes and types of pipe

DECISIONS	CUES	ERRORS
What types of fixture What is the duration of use of fixture What is the frequency of use of fixture	Type of building, e.g. school, residence, hotel, etc Refer to local codes	Inadequate supply to all fixtures Excessive cost overage from incorrect sizing

PERFORMANCE KNOWLEDGE (CON'T)

Select, using information from eleventh step, type of pipe
If water contains excessive hard water deposits, increase pipes by one standard size
Refer to local code and/or water utility department

(TASK STATEMENT) ADEQUATELY SIZE THE WATER DISTRIBUTION SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Fluids under pressure Inertia and momentum Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Use of Numbers (without calculation) Coding [as perschematic] Ratio Basic Arithmetic Skills and Concepts Ratio and proportion, Guess and check method, Rule of thumb, Finding a percent of a number and what percent one number is of another Rate Measurement: geometric Linear, volume Measurement: non-geometric Pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints, representational graphs [Static head charts and other performance charts]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending drawings, charts, tables	Comprehension, Detail/Inference, Description of mechanism
Writing	Making schematic drawings	Classification, Description
Viewing	Analysis of drawings	Visual analysis, Recognition of symbols, codes, emblems

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(TASK STATEMENT) INSTALL AN OVERHEAD GRAVITY FEED SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe wrenches Pipe cutting and threading tools Solder, flux, ''gas'' Pipe - steel, copper, etc Fittings - steel, copper, etc Centrifugal pump Piston pump Valves - gate, globe and check Hanger and supports Hammer, nails, screws Level Plumb bob Six foot rule Sand and cement Storage tank and water level controls	For pressure or gravity supply tank systems, show minimum water level at which tank is designed to operate at peak demand Select and install pumps Set pump control devices Install and support pipe, fittings, and valves to tank Install and support ''risers'' to fixture supply outlets Provide overflow and drain for tank Coordinate with other trades, e.g. equipment operators, electricians, welders, etc.	Hardhats Gloves Protection from fire if soldering or welding Proper rigging to set tank Proper support to hold weight of tank

DECISIONS	CUES	ERRORS
Determine if the system is compatable with the design of the structure Determine if water usage will prevent stagnation of the water stored in the tank	Type of structure, e.g. hotel, office building, warehouse, etc.	Increased cost to the customer Contamination of the water Unnecessary utilization of space

(TASK STATEMENT) INSTALL AN OVERHEAD GRAVITY FEED SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Centrifugal forces developed by bodies in rotation Resistance of materials to flow of electrical current Transfer of heat from one body to another Resistance of materials to change in shape	Set of real numbers [positive] Fundamental Operations (Calculations) Use of Numbers (without calculation) Coding, Ratio Basic Arithmetic Skills and Concepts Guess and check method, Rule of thumb ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area, volume Measurement: non-geometric Temperature, weight, liquid, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints, Representational Graphs [Performance charts] Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Symmetry, similarity, parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms Determination of area and volume of cylinders

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions	Comprehension, Detail/inference, Recommendation reports, Proposals, Description of mechanism, Terminology
Viewing	Installation	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, and emblems

(TASK STATEMENT) INSTALL UP-FEED SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe wrenches Pipe cutting and threading tools Solder, flux, ''gas'' Fittings - steel, copper, etc Jet pumps Submergible pumps Water storage tanks and hydropneumatic pressure devices Hanger and supports Level Plumb bob Six foot rule Valves - gate, globe, check, pressure reducing valve Standard hand tools Pipe- steel, copper, etc	For pressure or gravity supply tank systems, show minimum water level at which tank is designed to operate at peak demand Indicate the minimum pressure required for satisfactory operation at the highest (furthest) water outlet and minimum pressure available at all times at the source Select and install pump Install pipe, fittings, valves, supports for ''risers'' to fixture supply outlets Provide protection for installation and equipment Coordinate with other trades on the job	Provide for fire protection of soldering or welding Refer to OSHA requirement for construction trades
DECISIONS	**CUES**	**ERRORS**
Determine if the system is compatable with the design of the structure	Type of structure, e.g. hotel, office building, warehouse, etc	Increased cost to the customer Unnecessary utilization of space

(TASK STATEMENT) INSTALL UP-FEED SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Centrifugal forces developed by bodies in rotation Resistance of materials to flow of electrical current Transfer of heat from one body to another Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Use of Numbers (without calculation) - Coding, ratio Basic Arithmetic Skills and Concepts Guess and check method, Rule of thumb ''Measure sense''/role of ''unit'' Instruments, Measurement: geometric Linear, area, volume Measurement: non-geometric Temperature, weight, liquid, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints, Representational graphs [Performance charts] Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Symmetry, similarity, parallel, perpendicular Determination of area and volum of rectangular, cube and right triangular prisms Determination of area and volume of cylinders

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports, Proposals, Description of mechanism, Terminology
Viewing	Installation	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

(TASK STATEMENT) INSTALL A CIRCULATING WATER SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Pipe cutting and threading tools Solder, flux, "gas" Circulator Valves-gate, globe, check, pressure reducing valve Level Rule Water heating device Hangers and supports	Size system Select and install circulator Determine size of return line Install pipe, fittings, valve, supports for "risers" to fixture supply outlets Provide for expansion of return line Provide protection for installation and equipment Coordinate with other trades on the job	

DECISIONS	CUES	ERRORS
Determine if the system is compatable with the design of the structure	Type and size of structure	Increased cost to the customer Unnecessary utilization of space

(TASK STATEMENT) INSTALL A CIRCULATING WATER SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Centrifugal forces developed by bodies in rotation Resistance of materials to flow of electrical current Magnetic fields of force	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Use of Numbers (without calculation) Coding, ratio Basic Arithmetic Skills and Concepts Guess and check method, Rule of Thumb ''Measure sense''/role of ''unit'' Instruments, Measurement: geometric Linear, area, volume Measurement: non-geometric Temperature, weight, liquid, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints, Representational graphs [Performance charts] Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Symmetry, similarity, parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms Determination of area and volume of cylinders

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports, Proposals, Description of mechanism, Terminology
Viewing	Installation	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

(TASK STATEMENT) CONSTRUCT A PRESSURE REDUCING STATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Pipe cutting and threading tools Soldering tools and equipment Pipe, fittings, valves Hangers and supports Blueprints and specifications Local code regualtions	Size system Select pressure reducing valves Install main pipe, fittings, valves Size and build by pass Provide necessary hangers and supporters Protect work	Refer to OSHA requirements for the construction trades

DECISIONS	CUES	ERRORS
Determine number of stations necessary for structure	Type and size of structure Architects plans and specifications Local codes	Equipment requiring specific g.p.m. will not function properly or will not function at all

(TASK STATEMENT) CONSTRUCT A PRESSURE REDUCING STATION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect heating and cooling on expansion of materials Fluids under pressure Centrifugal forces developed by bodies in rotation Resistance of materials to flow of electrical current Transfer of heat from one body to another Resistance of materials to change in shape	Set of Real Numbers [Positive] Use of Numbers (without calculation) Coding, ratio Fundamental Operations (Calculation) Basic Arithmetic Skills and Concepts Guess and check method, Rule of thumb ''Measure sense''/role of ''unit'' Instruments; Measurement: geometric Linear, area, volume Measurement: non-geometric Temperature, weight, liquid, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints, Representational graphs [Performance charts] Recognize and identify basic geometry figures, plane and solid Knowledge of geometric relationships Symmetry, similarity, parallel, perpendicular Determination of area and volume of rectangular, cube and right triangular prisms Determination of area and volume of cylinders

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions,	Comprehension, Detail/Inference, Recommendation reports, Proposals, Description of mechanism, Terminology
Viewing	Installation	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, and emblems

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(TASK STATEMENT) INSTALL AUTOMATIC DOMESTIC WATER HEATER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Pipe cutting and threading tools Soldering tools and equipment Pipe, fittings, valves Vent pipe, fitting Electric wire Switch	Locate water heater site Remove ''old'' water heater Connect water heater to domestic hot water and domestic cold water Provide protection against electro-litic action Provide proper service for electric water heater Provide proper service for ''gas'' water heater Properly install relief valves on water heater If gas water heater, install proper vent Check local codes and utility company regulations	Improper handling of equipment

DECISIONS	CUES	ERRORS
Determine size of water heater that will meet the need	Type of occupancy Number of occupants	Insufficient hot water to meet the needs of occupancy

(TASK STATEMENT) INSTALL AUTOMATIC DOMESTIC WATER HEATER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism

(TASK STATEMENT) INSTALL COMMERCIAL WATER HEATING AND HOT WATER STORAGE EQUIPMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Oxy-Acetylene welding equipment Elec-welding equipment **Heavy moving equipment** Soldering tools and equipment Hangers and supports Concrete Blocking material Pipe, fitting, valves Pry bars Box end wrenches Pipe cutting and threading tools	Determine site for equipment Unload equipment on job site Move equipment into position Erect necessary supports and bracing for equipment Set equipment Connect hot and cold piping to heating equipment Connect circulating line between heating equipment and storage equipment Connect return hot water line to circulating line Install fuel service to heating equipment Check and set all safety and temperature controls	Improper handling of equipment at time of loading, moving, or setting

DECISIONS	CUES	ERRORS
Determine capacity/production size of equipment	Physical size of equipment in relation to proposed location	Failure of equipment to meet peak demand

(TASK STATEMENT) INSTALL COMMERCIAL WATER HEATING AND HOT WATER STORAGE EQUIPMENT

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Magnetic fields of force Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area Measurement: non-geometric Temperature, liquid, pressure Read and interpret tables, charts and graphs Representational graphs [Performance charts]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism

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(TASK STATEMENT) REPAIR CIRCULATING PUMP

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Allen wrench set Volt-Ohm's meter Oiler Manufacturer repair manuals Replacement component parts, e.g. bearing assembly, seal, etc. Replacement circulator pump	Check rotation of circulator Repair bearing assembly leaks Repair over-heating motor Isolate unusual pump noise	

DECISIONS	CUES	ERRORS
Determine if the problem is in the pump Determine if the problem is in the motor Determine manufacturer and model	No or inadequate circulation Water leak from bearing assembly Hot motor/tripping circuit breaker Loud or unusual noise	Failure to accomplish repairs

(TASK STATEMENT) REPAIR CIRCULATING PUMP

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Effect of heating and cooling on expansion of materials Magnetic fields of force Effects of friction on work processes and product quality	''Measure sense''/role of ''unit'' Instruments [Volt Ohm's meter] Measurement: non-geometric Temperature, liquid, speed Read and interpret tables, charts and graphs Representational graphs [Performance charts]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehensive written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism

(TASK STATEMENT) REPAIR LEAK IN DOMESTIC (HOUSE) WATER LINES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Cutting and threading tools Soldering tools and equipment Ultrasonic leak detector equipment Pipe fittings, valves Fill material (grits) Pressure gauge Manometer Mercury gauge	Determine origin of leak Expose area of apparent leak Determine exact location of leak Remove damage or leaking material Provide for protection of repair Test repair Close area of repair	Refer to OSHA requirements construction trades

DECISIONS	CUES	ERRORS
Determine type of material	Physically examine existing material	Failure to repair leaks

(TASK STATEMENT) REPAIR LEAK IN DOMESTIC (HOUSE) WATER LINES

SCIENCE	MATH – NUMBER SYSTEMS
Simple macines used to gain mechanical advantage Fluids under pressure Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, liquid, pressure Basic Geometry Skills and Concepts **(see appendix)**

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Listening		Auditory discrimination, Concentration, Logic, Noise discrimination
Viewing	''Wet spots''	Detail/Inference
Touching	Feel	Temperature, Motion

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(TASK STATEMENT) TROUBLESHOOT ELECTRIC WATER HEATER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Volt-Ohm's meter Small hand tools Thermometer Water pressure gauge Pipe cutting and threading tools Soldering tools and equipment Pipe, fittings, valves Replacement heater Replacement T&P valve Replacement elements and thermostats	Measure water temperature Measure pressure at source Repair water leaks Replace water heater Check for abnormal sounds Determine if service line is sufficient for heater	Turn off electricity and water to heater Electrical shock Explosion

DECISIONS	CUES	ERRORS
Identify specific problem Determine age of heater Determine the manufacturer and model of heater	No or not enough hot water Water too hot or not hot enough Water on floor around heater	Failure to accomplish repair Failure to satisfy customer

(TASK STATEMENT) TROUBLESHOOT ELECTRIC WATER HEATER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of heat from one body to another Resistance of materials to flow of electrical current	Set of Real Numbers [Positive] Fundamental Operations Basic Arithmetic Skills and Concepts Guess and check method, Rule of thumb ''Measure sense''/role of ''unit'' Instruments [Volt-Ohm's meter] Measurement: non-geometric Temperature, weight, liquid, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

(TASK STATEMENT) TROUBLESHOOT GAS WATER HEATER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Pressure gauge/inches of water column Pipe, fittings, valves New water heater Soldering tools and equipment Replacement thermostat Thermometer	Measure water temperature Measure pressure at source Repair water leaks Replace water heater Check for abnormal sounds Measure gas pressure Test thermocouple	Turn off gas and water to heater Burns Explosion

DECISIONS	CUES	ERRORS
Identify specific problem Select necessary repair parts Determine make and model of heater	Age of water heater No or not enough hot water Water too hot Unusual noises Water on floor around heater Gas odors	Failure to accomplish repair Failure to satisfy customer

(TASK STATEMENT) TROUBLESHOOT GAS WATER HEATER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of heat from one body to another Resistance of materials to flow of electrical current	Set of Real Number [Positive] Fundamental Operations Basic Arithmetic Skills and Concepts Guess and check method, Rule of thumb ''Measure sense''/role of ''unit'' Instruments [Volt-Ohm's meter] Measurement: non-geometric Temperature, weight, liquid, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

Duty F Install and/or Maintain Gas and/or Oil Systems

1 Excavate gas piping
2 Install plastic gas pipe
3 Install coated steel gas pipe
4 Install copper liquid petroleum gas service pipe
5 Install oil service lines
6 Install oil storage tank above ground
7 Install oil tank below ground
8 Test to find leaks (gas/oil service)

(TASK STATEMENT) EXCAVATE GAS PIPING

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pinch bars Back hoe Pick and shovel Sledge hammer Stakes Building line	Locate meter set Locate gas main Trench service line Back fill	Safety shoes Hard hat Gloves

DECISIONS	CUES	ERRORS
Determine type of meter **Determine if inside meter is set** **Determine if outside meter is set** **Determine pressure of gas line**	Gas company standard operating procedure	

(TASK STATEMENT) EXCAVATE GAS PIPING

SCIENCE	MATH – NUMBER SYSTEMS
Indestructibility of energy and matter Simple machines used to gain mechanical advantage Fluids under pressure Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology
Viewing	Area of excavation	Visual analysis, Describing, Detail/Inference

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(TASK STATEMENT) INSTALL PLASTIC GAS PIPE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tape Six foot rule Testing gauges Pump Air compressor Wrenches Saw Plastic pipe and fittings	Measure length of pipe Set prefab meter stations Make proper joints compression Test gas lines Wrap exposed metal and joints	Explosions Burns Poisons **Asphyxiation** **No ventilation**

DECISIONS	CUES	ERRORS
	Gas utility requirements	Loss of materials

(TASK STATEMENT) INSTALL PLASTIC GAS PIPE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Utility company requirement	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

(TASK STATEMENT) INSTALL COATED STEEL GAS PIPE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Welding equipment Welding rods Pipe threading machine Vice and dies Cutters Wraping equipment Anode bags Steel pipe and fittings Wrenches Rule	Grade trench Lay pipe Connect pipe Test pipe Wrap pipe Install anode bags Back fill	Poisonous gas Burns Asphyxiation

DECISIONS	CUES	ERRORS
	Local code Gas company regulation Pressure piping state code	

(TASK STATEMENT) INSTALL COATED STEEL GAS PIPE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of heat from one body to another Effect of friction on work processes and product quality Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Utility company requirement	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

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(TASK STATEMENT) INSTALL COPPER LIQUID PETROLEUM GAS SERVICE PIPE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Flar block Wrenches Tubing cutters Six foot rule Boxend wrenches Tubing Compression fittings Valves	Measure and cut tubing to desired length Slide one half of fitting on tubing Flare end of tubing Connect pipe Tighten flared fittings	Burns Poisons Asphyxiation

DECISIONS	CUES	ERRORS
Determine type of joint, flared or compression	Local code	

(TASK STATEMENT) INSTALL COPPER LIQUID PETROLEUM GAS SERVICE PIPE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Utility company requirement	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism. Terminology

(TASK STATEMENT) INSTALL OIL SERVICE LINES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe threading machine Cutters and dies Welding equipment Welding rods Wrenches Pipe and fittings Vice Six foot rule Back hoe Pick and shovel	Excavate Lay pipe Assemble pipe Test pipe Back fill	Hard hat Safety shoes Safety glasses Burns

DECISIONS	CUES	ERRORS
Determine depth of pipe	Local code	

(TASK STATEMENT) INSTALL OIL SERVICE LINES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Utility company requirement	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

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(TASK STATEMENT) INSTALL OIL STORAGE TANK ABOVE GROUND

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wrenches Equipment to lift tank Oxy-Acetylene cutting equipment Welding equipment Steel Oil tank trim fittings Pipe, valves, and fittings Pipe cutting and threading equipment	Determine size of tank Set tank rack or build support Mount tank Install tank trim Connect supply line Install tank vent Pressurize, install and check for leaks Provide for protection of work	Burns Explosions Fire

DECISIONS	CUES	ERRORS
Determine how to adequately support the tank	Physical dimensions of tank	Tank support failure Ruined piping and damage to tank

(TASK STATEMENT) INSTALL OIL STORAGE TANK ABOVE GROUND

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Set tank **Demonstration**	Visual analysis, Detail/Inference

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(TASK STATEMENT) INSTALL OIL TANK BELOW GROUND

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Equipment to lift tank Wrenches Pipe cutters Dies Welding equipment Back hoe Pick and shovel Pipe, valves, and fittings Backfill material Anode bags Ground anchors Steel cable	Determine size of tank Excavate for tank Anchor tank in ground Install anode bags Make service connections Install tank fill pipe and tank vent Pressurize installation and check for leaks Get inspection Backfill	Fire Explosions

DECISIONS	CUES	ERRORS
Determine the depth and location for tank installation	National Board of Fire Underwriters Local code Physical dimensions of tank	Improper installation Failure to pass inspection

(TASK STATEMENT) INSTALL OIL TANK BELOW GROUND

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, fricrion and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Set tank demonstration	Visual analysis, Detail/Inference

134

(TASK STATEMENT) TEST TO FIND LEAKS (GAS/OIL SERVICE)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Leak detector kit Excavation equipment Test equipment	Locate leak underground Excavate to leak Make repair Apply gauges test for leaks Back fill	Explosions Fire

DECISIONS	CUES	ERRORS
Determine type of service line	Physical examination of pipes	Continuous leaking

(TASK STATEMENT) TEST TO FIND LEAKS (GAS/OIL SERVICE)

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations "Measure sense"/role of "unit" Instruments Measurement: geometric Linear Measurement: non-geometric Weight, pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehension of written instructions	Understanding local utility company requirements

136

Duty G Install and/or Maintain Gas and/or House Lines

1 Fabricate meter setting
2 Install house lines
3 Test house lines for leaks
4 Repair gas leaks in multi-story
5 Adjust using appliance for proper combustion
6 Adequately size pipe to using equipment

(TASK STATEMENT) FABRICATE METER SETTING

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Threading machine Stock and dies Wrenches Pipe cutters Reamer Drill Saws Drawing Six foot rule Lock valves Meter bar Pipe and fittings	Consult gas company for type of meter set purchase meter bar Drill openings to point of appliance set Run gas lines to point of appliance set Valve and cap lines Test gas line Connect at least one appliance Have gas company turn on gas	Fire Explosions

DECISIONS	CUES	ERRORS
Determine location of meter set	Drawings and code (local)	Relocation

(TASK STATEMENT) FABRICATE METER SETTING

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehend written instructions **Local utility company requirements**	**Comprehension, Detail/Inference, Description of mechanism, Terminology**

139

(TASK STATEMENT) INSTALL HOUSE LINES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Threading machine Stock and dies Cutters Oiler Pipe and fittings Wrenches Reamer Drawings Drill Saws Welding equipment Welding rod Anchors Pipe hangers	Cut chasis Drill openings Run gas line Weld joints Seal joints Fabricate pipe Test gas lines Connect appliances	Safety glasses Gloves Hard hat Fire Burns
DECISIONS Determine size of gas lines	**CUES** Drawings	**ERRORS**

(TASK STATEMENT) INSTALL HOUSE LINES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Centrifugal forces developed by bodies in rotation Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehend written instructions **Local utility company requirements**	**Comprehension, Detail/Inference, Description of mechanism, Terminology**

(TASK STATEMENT) TEST HOUSE LINES FOR LEAKS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Ether Air pump Test gauges Soap Brush Cutter Dies Valves Fittings Caps Ultra sonic leak detector	Valve lines and/or cap lines Remove gas meter Set pump and gauges Test line Locate leak and repair same Replace meter	Fires Explosions Poisons Asphyxiation Burns

DECISIONS	CUES	ERRORS
Determine method of testing	Odor	Failure to find leaks

(TASK STATEMENT) TEST HOUSE LINES FOR LEAKS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Wrok input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Centrifugal forces developed by bodies in rotation Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehend written instructions Local utility company requirements	Comprehension, Detail/Inference, Description of mechanism, Terminology

143

(TASK STATEMENT) REPAIR GAS LEAKS IN MULTI-STORY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Ether Air pump Test guages Soap Brush Cutter Dies Valves Fittings Ultra-sonic leak detector	Section off building Test each section separately Valve lines and/or cap lines Cut branch off main Test branch Locate leak and repair leak Reconnect branch to main	Fire Explosion Poisons Asphyxiation Burns

DECISIONS	CUES	ERRORS
Determine what section to start to test first	Odor	

(TASK STATEMENT) REPAIR GAS LEAKS IN MULTI-STORY

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Centrifugal forces developed by bodies in rotation Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehend written instructions Local utility company requirements	Comprehension, Detail/Inference, Description of mechanism, Terminology

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(TASK STATEMENT) ADJUST USING APPLIANCE FOR PROPER COMBUSTION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Screwdrivers Open end wrench Matches	Unscrew retaining screw on air shutter Adjust air shutter until the proper amount of air is mixed with the gas Tighten retaining screw	Burns

DECISIONS	CUES	ERRORS
Determine if flame if proper	Color of flame Floating flame	Improper combustion

(TASK STATEMENT) ADJUST USING APPLIANCE FOR PROPER COMBUSTION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending manufacturer's instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology
Viewing	Visual analysis of flame	Visual analysis, Describing, Detail/Inference

(TASK STATEMENT) ADEQUATELY SIZE PIPE TO USING EQUIPMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Charts Formulas Pencil Paper	Check rating plate on equipment B.T.U. input and B.T.U. output Check chart and/or use formula Make conversion to cubic feet of gas	Burns Explosion Poisons Asphyxiation
DECISIONS Determine if source of available fuel is adequate	**CUES** Size of burner's orifice	**ERRORS** Inadequate supply of gas at peak time

(TASK STATEMENT) ADEQUATELY SIZE PIPE TO USING EQUIPMENT

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area, volume Measurement: non-geometric Temperature, weight, pressure Read and interpret tables, charts and graphs Scale drawings/floor plans/blueprints Representational graphs [Performance charts] Basic Arithmetic Skills and Concepts Ratio and proportion

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending manufacturer's instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

149

Duty H Install and/or Maintain Hydronic Heating Systems

1 Determine heat loss for structure
2 Install cast iron sectional boiler
3 Install cast iron packaged boiler
4 Install horizontal steel tube boiler
5 Install expansion tank
6 Install finn tub radiation
7 Install cast iron baseboard radiation
8 Install circulating pump
9 Install breeching
10 Install pressure regulator and automatic water feeder
11 Install header and ''hartford loop''
12 Select and install valves for heating system
13 Install steam traps
14 Replace relief valve
15 Repair circulating pump
16 Troubleshoot control system hot water boiler
17 Troubleshoot control system for steam boiler
18 Check for improper combustion
19 Repair leak in radiant floor coil system

(TASK STATEMENT)
DETERMINE HEAT LOSS FOR STRUCTURE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Formula Charts Pencil Pad Six foot rule 100 foot tape	Measure area Identify outside wall with openings Measure openings of window and doors Measure ceiling height Select constant for various building materials Total all B.T.U.'s	

DECISIONS	CUES	ERRORS
Determine size of boiler to install	Type of building materials Type window and doors	Not sufficient heat

(TASK STATEMENT) DETERMINE HEAT LOSS FOR STRUCTURE

SCIENCE	MATH – NUMBER SYSTEMS
Ref. I.B.R. Hydraulic course	I.B.R. heat calculating procedure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Written instructions - I.B.R.	Comprehension, Description of mechanism, Terminology

(TASK STATEMENT) INSTALL CAST IRON SECTIONAL BOILER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Hydraulic jack Sledge hammer Framing material Cement Sand Shovel Water Socket set (large) Openend wrenches Pipe wrenches Steel wool Cleaning cloth Solvent	Build setting pad Clean nipple port and nipples of boiler Set first section of boiler on pad Insert push nipples into ports Set second section and hinge up with 1st section Press until sections are closed Seal with furnace cement Install jacket	Safety glasses Safety shoes Gloves Improper use of tools Improper handling of equipment

DECISIONS	CUES	ERRORS
Determine position to set boiler in relation to combustible walls	Location of chimney and size of room	Broken section

(TASK STATEMENT) INSTALL CAST IRON SECTIONAL BOILER

SCIENCE	MATH – NUMBER SYSTEMS
Ref. I.B.R./A.S.M.E. requirements	Ref. I.B.R./A.S.M.E. requirements

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Ref. I.B.R./A.S.M.E. requirements		

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(TASK STATEMENT) INSTALL CAST IRON PACKAGED BOILER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wrecking bar Claw hammer Wire cutters Shovel Cement Sand Water Cleaning cloth	Build cement base Set boiler Install boiler jacket	Safety shoes Gloves Improper handling of equipment

DECISIONS	CUES	ERRORS
Decide boiler room size	Location of chimney	Sizing boiler

(TASK STATEMENT) INSTALL CAST IRON PACKAGED BOILER

SCIENCE	MATH – NUMBER SYSTEMS
Ref. I.B.R./A.S.M.E. requirements	Ref. I.B. R./A.S.M.E. requirements

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Ref. I.B.R./A.S.M.E. requirements		

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(TASK STATEMENT) INSTALL HORIZONTAL STEEL TUBE BOILER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Crow-bar Pinch bar Claw hammer Cement Sand Water Shovel Six foot rule Level Framing materials Nails Block and tackle Rope or cable Boiler Bolts Nuts	Build ash dip Set anchor bolts Unload equipment Move equipment into position Set boiler	Handling of equipment

DECISIONS	CUES	ERRORS
Determine who is to move boiler and equipment	Size of boiler and equipment	Damaged equipment and/or boiler

(TASK STATEMENT) INSTALL HORIZONTAL STEEL TUBE BOILER

SCIENCE	MATH – NUMBER SYSTEMS
Ref. I.B.R./A.S.M.E. requirements	Ref. I.B.R./A.S.M.E. requirements

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Ref. I.B.R./A.S.M.E. requirements		

158

(TASK STATEMENT) INSTALL EXPANSION TANK

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Six foot rule Pipe cutters Dies Welding equipment Angle iron Welding rods Pipe Block and tackle Cable Rope	Measure length and diameter of tank Design and build wrack Check height of water line in boiler Mount tank Connect tank Install exhaust pipe Put into operation	Burns Explosions

DECISIONS	CUES	ERRORS
Set height of expansion tank	Water line	Waterlog

(TASK STATEMENT) INSTALL EXPANSION TANK

SCIENCE	MATH – NUMBER SYSTEMS
Ref. I.B.R./A.S.M.E. requirements	Ref. I.B.R./A.S.M.E. requirements

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Ref. I.B.R./A.S.M.E. requirements		

160

(TASK STATEMENT) INSTALL FINN TUB RADIATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Claw hammer Saw Hack saw Tin snips **Screwdriver** Pencil Level Soldering equipment Solder Pipe cutters Pipe threading machine **Stock and dies** Vice Screws Nails	Determine number of feet Fasten back panel to wall Cut Finn tubing to fit Install vents Connect to risers Install valve openings and pair end caps or corner panels inside or outside Install damper Install front panel	Safety glasses Gloves Safety shoes Cuts Burns

DECISIONS	CUES	ERRORS
Determine height to install radiation B.T.U. rating per foot	Height of ceiling - baseboard space	Discomfort - too much or too little heat

(TASK STATEMENT) INSTALL FINN TUB RADIATION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of energy from one form to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

162

(TASK STATEMENT) INSTALL CAST IRON BASEBOARD RADIATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Radiator tools Pipe wrenches Pipe threading machine Stock and dies Vice Soldering equipment Flux Screws Screwdriver	Determine number of B.T.U.'s required Measure length of wall Assemble number of section needed to fit wall or satisfy B.T.U. requirement Install valves Connect to risers and return Install vents	Gloves Safety glasses Safety shoes

DECISIONS	CUES	ERRORS
Determine B.T.U. rating/foot	Baseboard	Discomfort - too much or too little heat

(TASK STATEMENT) INSTALL CAST IRON BASEBOARD RADIATION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detial/Inference, Recommendation reports, Description of mechanism, Terminology

164

(TASK STATEMENT) INSTALL CIRCULATING PUMP

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Openend wrenches Socket set Pipe wrenches Screwdriver	Position pump as close to the boiler as possible Screw flanges on return line Turn motor body to wall Wire motor to acquistat and relay Check make sure water is pumped in desired direction	Safety glasses Improper equipment handling

DECISIONS	CUES	ERRORS
Determine static head	Number of gallons to circulate	Rotation of impeller

(TASK STATEMENT) INSTALL CIRCULATING PUMP

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Magnetic fields of force	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

166

(TASK STATEMENT) INSTALL BREECHING

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Refractory materials Welding equipment Chisels Hammers Socket set Openend wrenches Chimney Boiler	Scribe for hole in chimney Make opening in chimney Measure distance from boiler port to chimney opening Fabricate breeching Secure breeching to boiler Seal space between breeching and chimney Cover breeching	Burns Gloves

DECISIONS	CUES	ERRORS
Decide chimney size Decide chimney liner	Area of chimney Height of chimney	Spilage and smoke in boiler room

(TASK STATEMENT) INSTALL BREECHING

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Transfer of heat from one body to another Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

168

(TASK STATEMENT) INSTALL PRESSURE REGULATOR AND AUTOMATIC WATER FEEDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Soldering equipment Solder Pipe threading machine Stock and dies Pipe wrenches Valves Dual controls Bell wire Side cutters Wire strippers Friction tape Automatic water feeder Glass gauge	Install ''Y's'' on boiler ports on front Screw ½ unions into automatic water feeder Tighten unions Pipe water to control Install bypass Wire to high limit control	Fire Explosions

DECISIONS	CUES	ERRORS
Decide how to locate on or as close to boiler as possible	Type of control	Burst boiler or burned-out boiler

(TASK STATEMENT) INSTALL PRESSURE REGULATOR AND AUTOMATIC WATER FEEDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

170

(TASK STATEMENT) INSTALL HEADER AND ''HARTFORD LOOP''

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe wrenches Welding equipment Welding rods Pipe Fittings Valves Pipe threading machines Stock and dies Cutters Support and lifting materials	Determine height of header Assemble pipe on boiler Insert ''tee'' in header for ''hartford loop'' Assemble hartford loop on return line Connect return line to boiler	Gloves Safety glasses Safety shoes Burns Explosions

DECISIONS	CUES	ERRORS
Determine size of piping for heater	Ceiling height Local and/or state code	Burned out boiler or burst boiler

(TASK STATEMENT) INSTALL HEADER AND ''HARTFORD LOOP''

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

(TASK STATEMENT) SELECT AND INSTALL VALVES FOR HEATING SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe cutting and threading equipment Pipe and fittings Valves Welding equipment Welding rods	Install valve near boiler Install valve on each branch Install valve at each heating element Install valve on return near boiler Tighten bonnet on valve	

DECISIONS	CUES	ERRORS
Determine points of valve installation **Select proper valves**	Size of pipe Pressure psi	Water hammer Poorly designed system

(TASK STATEMENT) SELECT AND INSTALL VALVES FOR HEATING SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Transfer of heat from one body to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

(TASK STATEMENT) INSTALL STEAM TRAPS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe cutting and threading equipment Pipe threading machine Pipe and fittings Traps Pipe wrenches	Cut and thread pipe Insert traps Tighten unions	Burns

DECISIONS	CUES	ERRORS
Determine location of trap Determine type of trap to use	Grade of pipe System pressure System design	No heat Excess noise - water hammer

(TASK STATEMENT) INSTALL STEAM TRAPS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechaical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of energy from one form to another	Set of Real Number [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

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(TASK STATEMENT) REPLACE RELIEF VALVE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe wrenches Pipe and fittings Pipe cutting and threading equipment Pipe threading machine	Remove old relief valve Replace new valve Construct drip leg	Burns Explosions

DECISIONS	CUES	ERRORS
Decide proper setting of temperature and pressure	Continuous running	Burst boiler

(TASK STATEMENT) REPLACE RELIEF VALVE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of energy from one form to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

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(TASK STATEMENT) REPAIR CIRCULATING PUMP

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Volt meter Socket set Screwdriver Needle nose pliers	Check fuse and/or circuit breaker Check coupler of motor Check impeller Check continuity of motor Repair and/or replace defective part	Electric shock

DECISIONS	CUES	ERRORS
Determine whether to rewind or replace motor	Odor Meter indications	Failure to effect repair

(TASK STATEMENT) REPAIR CIRCULATING PUMP

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of energy from one form to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

(TASK STATEMENT) TROUBLESHOOT CONTROL SYSTEM HOT WATER BOILER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Volt meter Friction tape Screwdriver Needle nose pliers End wrenches Socket set (small) Side cutters	Check thermostat Check relay Check acquastat Check gas control valve Check transformer Check pilot Check thermocouple Check wiring Check fuse and/or circuit breaker	Burns Electric shock

DECISIONS	CUES	ERRORS
Determine whether to repair and/or replace control	Broken wire No flame on pilot Pilot would not stay lit	

(TASK STATEMENT) TROUBLESHOOT CONTROL SYSTEM HOT WATER BOILER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechaical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of energy from one form to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

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(TASK STATEMENT) TROUBLESHOOT CONTROL SYSTEM FOR STEAM BOILER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Volt meter Screwdriver Socket set Needle note pliers Side cutters Friction tape Boiler controls End wrenches	Check pressure control Check high limit control Check low limit control Check diaphragm valve Check low water cut off Check automatic water feeder Check thermostat Check thermocouple Check pilot Check wiring Check transformer Check relay Check baso valve	Electric shock

DECISIONS	CUES	ERRORS
Decide to replace and/or repair control		

(TASK STATEMENT) TROUBLESHOOT CONTROL SYSTEM FOR STEAM BOILER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure Transfer of energy from one form to another	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Terminology

(TASK STATEMENT) CHECK FOR IMPROPER COMBUSTION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Flame mirror Draft gauge Combustion testing kit Openend wrenches Socket set (small)	Check color of flame Conduct CO_2 test Check draft Adjust air intake on burners Check fresh air inlet (''outside air'')	Ignition Explosion

DECISIONS	CUES	ERRORS
Decide correct mixture of oxygen and gas Decide size of orifice on burner	Color of flame Floating flame	Accumulation of gas and/or oil

(TASK STATEMENT) CHECK FOR IMPROPER COMBUSTION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Examining plans	Visual analysis, Describing, Detail/ Inference, Color discrimination

(TASK STATEMENT) REPAIR LEAK IN RADIANT FLOOR COIL SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Ultra-sonic leak detector Air compressor Jack hammer Sledge hammer Cole chisels Cement Sand Water Pipe machine Pipe threading machine Pipe wrenches Welding equipment Weld cutting equipment	Locate leak Expose leak Repair leak Repair broken floor	Safety glasses Safety shoes Hard hat

DECISIONS	CUES	ERRORS
Decide whether to repair leak or abandon system	Extent of leak	Lost house

(TASK STATEMENT) REPAIR LEAK IN RADIANT FLOOR COIL SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing Listening	Examine	Visual analysis, Memory, Describing Audio discrimination

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Duty I Install and/or Maintain Fire Protection Systems

1 Determine quantity and rate of demand for water
2 Install standpipe with hose and siamese connection
3 Install wet-sprinkler system
4 Install dry-sprinkler system
5 Repair dry-sprinkler station

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(TASK STATEMENT) DETERMINE QUANTITY AND RATE OF DEMAND FOR WATER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Paper Pencil Scale Floor plan drawing Elevation plan drawing	Determine pressure at source Calculate total area of structure Compute g.p.m. needed per 1000 sq. ft. of area	

DECISIONS	CUES	ERRORS
Check calculations	**Determination appears reasonable based on prior experience**	Failure to provide adequate water supply if calculation error has occurred

(TASK STATEMENT) DETERMINE QUANTITY AND RATE OF DEMAND FOR WATER

SCIENCE	MATH – NUMBER SYSTEMS
	NBFU $Q = 1{,}020 \sqrt{P} (1 - 0.01 \sqrt{P})$ (P = sq. ft. in thousands) (Q = demand in gpm)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instruction	Comprehension, Detail/Inference, Informational reports, Description of mechanism, Definition, Terminology

(TASK STATEMENT) INSTALL STANDPIPE WITH HOSE AND SIAMESE CONNECTION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Pipe cutting and threading tools Hangers and supports Pipe, fittings, valves Siamese fittings First-aid hoses with drop racks and cabinets	Size standpipe Select location for fire-hose stations Install pipe, fittings, valves Support pipe Install first-aid hoses and cabinets Select locations for siamese connection Install siamese connections Provide for protection of installations and equipment Provide for draining system Test and activate system	Refer to OSHA requirements for construction trades

DECISIONS	CUES	ERRORS
Select the location for fire-hose station near center of structure	Design of structure	Failure to provide adequate fire protection

(TASK STATEMENT) INSTALL STANDPIPE WITH HOSE AND SIAMESE CONNECTION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Informational reports, Description of mechanism, Definition, Terminology

(TASK STATEMENT) INSTALL WET-SPRINKLER SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Pipe cutting and threading tools Hanger and supports Pipe, fittings, valves Sprinkler heads Alarm sensors Alarm bells Lead and oakum Lead working tools and equipment Indicator posts	Size supply mains, risers and runs Provide for pipe runs through walls and floors Install pipe, fittings, valves Install indicator stations Install sprinkler heads Provide for protection of installation Provide for draining system Install alarm sensors and alarm bells Test and activate system Provide for both vertical and horizontal support for piping	Refer OSHA requirements for construction trades
DECISIONS Determine location, spacing, number and type of sprinkler heads	**CUES** Design of structure Local codes NBFU requirements	**ERRORS** Failure to provide adequate fire protection

(TASK STATEMENT) INSTALL WET-SPRINKLER SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Speed/Rate, Informational reports, Description of mechanism, Definition and terminology

(TASK STATEMENT) INSTALL DRY-SPRINKLER SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Pipe cutting and threading tools Hangers and supports Pipe, fittings, valves Dry station valves Indicator posts Sprinkler heads Alarm sensors Alarm bells Lead and oakum Lead working tools and equipment Pressure gauges	Install air pipe and valves to riser stations Install air compressor Coordinate with electrical trade for wiring to compressor **Note: Refer to Performance Knowledge in "Install Wet-Sprinkler System"**	Refer OSHA requirements for construction trades

DECISIONS	CUES	ERRORS
Determine location, spacing, number and type of sprinkler heads **Determine size of air compressor**	Design of structure Number of riser stations Local codes NBFU requirements	Failure to provide adequate fire protection Failure to provide adequate air pressure to dry-valves

(TASK STATEMENT) INSTALL DRY-SPRINKLER SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Speed/Rate, Informational reports, Description of mechanism, Definition and terminology

(TASK STATEMENT) REPAIR DRY-SPRINKLER STATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Manufacturer's repair kits Valves and fittings Pressure gauges Gasket material Packing material Valve discs - soft	Shut-off indicator post to station **Drain water head above flapper of valve** **Turn off air to station air and purge air from station** **Disassemble valve and make necessary repairs** **Carefully close dry valve** **First fill system with air, then turn water into system**	**Failure to follow the steps in sequence could result in a wet machanic**

DECISIONS	CUES	ERRORS
Determine the type of repair Choose the proper material to make repair	Loss of air pressure Visible water leaks Premature opening of system	The station will remain in condition before attempted repair The station will be in worse condition

(TASK STATEMENT) REPAIR DRY-SPRINKLER STATION

SCIENCE	MATH – NUMBER SYSTEMS
Simple macines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers[Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Speed/Rate, Informational reports, Description of mechanism, Definition and terminology

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Duty J Install and/or Maintain Private Sewer Disposal Systems

1 Make soil percolation test
2 Excavate for septic tank
3 Excavate for leaching field
4 Backfill excavation
5 Repair broken piping in filter bed
6 Clean septic tank
7 Repair motor on aeration tank

(TASK STATEMENT) MAKE SOIL PERCOLATION TEST

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Stop watch Spade Post hole digger Water Shovel Rule Stakes Chalk Hammer Pick	Dig three test holes one foot square as deep as disposal trench Fill each hole with six inches of water Check time in minutes for water to seep away Add the percolation rate of each hole and divide by the number of holes	

DECISIONS	CUES	ERRORS
Determine correct number of square feet of absorption area	Type of soil and/or soil condition	Soggy filter bed

(TASK STATEMENT) MAKE SOIL PERCOLATION TEST

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) Basic Arithmetic Skills and Concepts Ratio and proportion "Measure sense"/role of "unit" Instruments Measurement: geometric Linear, area, volume Use of variables In formulae, in equations

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Progress reports, Terminology
Touching		Texture

(TASK STATEMENT) EXCAVATE FOR SEPTIC TANK

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Back hoe Pick and shovels Level Dump truck Front-end loader Septic tank	Sizing of septic tank Locate the setting of tank Excavate for tank Lower tank into hole Fill tank with water Back fill around tank Remove excess dirt	Hard hat Safety shoes Gloves

DECISIONS	CUES	ERRORS
Decide location of tank	Number of people to serve	Flooding of leaching bed

(TASK STATEMENT) EXCAVATE FOR SEPTIC TANK

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear, area

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Oral instructions	Terminology, Diction, Clarity of expression, Denotation/Connotation, Logic, Gestures
Viewing	Inspection of area	Visual analysis, Describing, Detail/ Inference, Recognition of symbols, codes, emblems

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(TASK STATEMENT) EXCAVATE FOR LEACHING FIELD

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pick and shovel Back hoe Level Front-end loader Stakes Hammer Vitrified clay pipe Distribution box Cement Sand Water	Measure area to be excavated Stake area to be excavated Excavate area of field Fill bottom of field with gravel On the gravel spread two feet of sand Set distribution box Lay leaching tile Cover tile with straw Back fill leaching bed	Hard hat Gloves Safety shoes
DECISIONS **Determine size of filter bed**	**CUES** Number of people	**ERRORS** Soggy filter bed

(TASK STATEMENT) EXCAVATE FOR LEACHING FIELD

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Resistance of materials to change in shape	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear, area

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Oral instructions	Terminology, Diction, Clarity of expression, Denotation/Connotation, Logic, Gestures
Viewing	Inspection of area	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

(TASK STATEMENT) BACKFILL EXCAVATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pick and shovels Front-end loader Dump truck Topsoil Sod	Shovel topsoil over **Leach field fill to line of contour of previous elevation grade by hand** Allow to settle Refill and grade by hand shoveling Haul excess soil away Plant grass	**Hard hat** **Safety shoes** **Gloves**

DECISIONS	CUES	ERRORS
Decide where to dispose of excess fill		Failure to back fill after settlement

(TASK STATEMENT) BACKFILL EXCAVATION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Reference, Recommendation reports
Touching	Soil materials	Size, motion

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(TASK STATEMENT) REPAIR BROKEN PIPING IN FILTER BED

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pick shovel Vitrified clay pipe	Locate broken tile Excavate broken tile Remove broken tile Replace broken tile Back fill Grade to previous elevation	Gloves Rubber boots
DECISIONS	**CUES**	**ERRORS**
Make repairs	Wet spots	Continuous wet spots

(TASK STATEMENT) REPAIR BROKEN PIPING IN FILTER BED

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Directions	Terminology, Clarity of expression, Logic

(TASK STATEMENT) CLEAN SEPTIC TANK

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Truck with holding tank Gas pump Pick and shovels Pinch bar Hose	Locate septic tank Uncover top of tank Remove septic tank cover Allow time for gas to escape Insert hose Pump contents of tank out into container Dispose of sludge	Explosions Gas Burns

DECISIONS	CUES	ERRORS
Decide where to dispose of sludge		

(TASK STATEMENT) CLEAN SEPTIC TANK

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Directions	Terminology, Clarity of expression, Logic

(TASK STATEMENT) REPAIR MOTOR ON AERATION TANK

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Volt meter Lifting equipment	Check circuit breaker and/or fuse Check continuity of motor Check rotation of motor Pull motor and/or repair Replace motor	Electric shock

DECISIONS	CUES	ERRORS
Determine whether to repair or to replace	No agitation Shaft coupler and/or unusual noise Motor overheating	Failure to accomplish repair

(TASK STATEMENT) REPAIR MOTOR ON AERATION TANK

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Description of mechanism, Definition

214

Duty K Set and/or Repair Fixtures and Fixture Trim

1 Set fixture hangers and supports
2 Seal fixtures to walls and/or floors
3 Seal trim to fixture
4 Anticipate shut-fowns for production, convenience and safety
5 Prepare area for fixture replacement

215

(TASK STATEMENT) SET FIXTURE HANGERS AND SUPPORTS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Level Rough-in manuals Fasterners, e.g. nails, screws, etc Pencil or marking crayon Caulk line Wood Angle, flat, channel iron Oxy-Acetylene cutting equipment Electric welding equipment Arm and chair carriers Sand and cement	Measure point of Set backing into walls Secure side and foot of chair carriers Set and anchor arm carriers Build ''special'' support or carrier	Refer OSHA requirements for construction trades
DECISIONS Determine make and model of fixtures	**CUES** Manufacturer's rough-in manuals	**ERRORS** Fixtures not properly supported could become damaged through use

(TASK STATEMENT) SET FIXTURE HANGERS AND SUPPORTS

SCIENCE

Simple machines used to gain mechanical advantage
Work input, work output, friction and efficiency in simple machines
Effect of heating and cooling on expansion of materials

MATH – NUMBER SYSTEMS

Set of Real Numbers [Positive]
Fundamental Operations (Calculation)
"Measure sense"/role of "unit"
Instruments
Measurement: geometric
Linear

COMMUNICATIONS

PERFORMANCE MODES

Reading

EXAMPLES

Comprehending written instructions

SKILLS/CONCEPTS

Comprehension, Detail/Inference, Recommendation reports, Description of mechanism, Definition

(TASK STATEMENT) SEAL FIXTURES TO WALLS AND/OR FLOORS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Sealing compound, e.g. silicone, putty, etc Socket set Box-end wrenches White grout Sheet lead Wax seals Felt seals	Set sealing material to fixture Set fixture to hanger or support ''Bolt'' fixture tightly to support Fill ''gaps'' around fixture with silicone or grout to provide sanitary seal	Refer OSHA requirements for building trades

DECISIONS	CUES	ERRORS
Choose correct rough-in manual	Unusual difficulty in installation	Damage or broken fixtures Leaks from fixture seals

(TASK STATEMENT) SEAL FIXTURES TO WALLS AND/OR FLOORS

SCIENCE	MATH – NUMBER SYSTEMS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Directions	Terminology, Clarity of expression

219

(TASK STATEMENT) SEAL TRIM TO FIXTURE

220

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Sealing compound, e.g. silicone, putty, etc Special hand tools Fasteners, e.g. nails, screws, etc	Read carefully manufacturer's instructions Center trim to fixture Apply sealing compound to trim Attach trim to fixture - tighten and clean excess compound	

DECISIONS	CUES	ERRORS
Decide type of sealing compound to use	Material fixture is made of	Leak around trim

(TASK STATEMENT) SEAL TRIM TO FIXTURE

SCIENCE	MATH – NUMBER SYSTEMS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Description of mechanism, Definition

221

(TASK STATEMENT) ANTICIPATE SHUT-DOWNS FOR PRODUCTION, CONVENIENCE AND SAFETY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
	Coordinate with customer Coordinate with other trades Brief mechanics for efficient operation	

DECISIONS	CUES	ERRORS
Select personnel to perform job function	Type of operation, e.g. factory, residence, etc	Inconvenience to customer

(TASK STATEMENT) ANTICIPATE SHUT-DOWNS FOR PRODUCTION, CONVENIENCE AND SAFETY

SCIENCE	MATH – NUMBER SYSTEMS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking Listening	Giving oral instructions Receiving oral instructions	Terminology, Diction, Clarity of expression, Denotation/Connotation Concentration, Logic, Word definition, Note taking

223

(TASK STATEMENT) PREPARE AREA FOR FIXTURE REPLACEMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools "New" fixtures Special hand tools Sheet plastic or paper Drop cloths	Examine area Determine fixture to be replaced Examine existing piping Provide for minor demolition of fixture area and protection of adjacent areas Carefully remove old fixture	

DECISIONS	CUES	ERRORS
Determine what material of existing plumbing **Determine** age of old fixture installed	Age of structure Type of fixture to be replaced	Failure to effect replacement properly Failure to meet local codes Damage materials and/or area adjacent to work

(TASK STATEMENT) PREPARE AREA FOR FIXTURE REPLACEMENT

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instruction	Comprehension, Detail/Inference, Recommendation reports, Progress report and description of mechanism
Viewing	Inspection area	Detail/Inference

225

Duty L Repair Plumbing Fixtures and/or Fixture Trim

1 Anticipate shut-downs in regard to production schedules, convenience, safety
2 Prepare area of fixture for repair work
3 Locate and clear stoppage in fixtures and drains
4 Locate and clear stoppage in water lines
5 Repair faucets, ball-cock valves, flushmeter

(TASK STATEMENT) ANTICIPATE SHUT-DOWNS IN REGARD TO PRODUCTION SCHEDULES, CONVENIENCE, SAFETY 227

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
	Coordinate with customer Coordinate with other trades ''Brief'' mechanic for efficinet completion of work	

DECISIONS	CUES	ERRORS
What is the specific problem **Decide whether to repair or replace** Choice of mechanic for job	Item to be repaired Age and condition of unit	**Failure to complete repair within reasonable time**

(TASK STATEMENT) ANTICIPATE SHUT-DOWNS IN REGARD TO PRODUCTION SCHEDULES, CONVENIENCE, SAFETY

SCIENCE	MATH – NUMBER SYSTEMS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Give oral instructions	Terminology, Diction, Clarity of expression, Denotation/Connotation
Listening	Receiving oral instructions	Concentration, Logic, Word definition, Note taking

228

(TASK STATEMENT) PREPARE AREA OF FIXTURE FOR REPAIR WORK

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Sheet plastic or paper Drop cloths	Examine area of work Examine existing pipe Protect adjacent areas	

DECISIONS	CUES	ERRORS
Determine what is the design and composition of existing material	Age of the structure Age and type of unit to be repaired	Failure to effect repair Damage to existing adjacent materials

(TASK STATEMENT) PREPARE AREA OF FIXTURE FOR REPAIR WORK

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Progress reports, Description of mechanism
Viewing	Inspection area	Detail/Inference

230

(TASK STATEMENT) LOCATE AND CLEAR STOPPAGE IN FIXTURES AND DRAINS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Special hand tools Electric ''sewer'' machines Water hose Dye coloring Replacement parts, e.g. fixture trap, clean-out plugs Extension ladders Mechanics mirror	Remove fixture trap Remove water closet Remove clean-out plug Apply proper tool or machine to clear stoppage Flush with water Replace trap, clean-out plug, reset closet	Never stand directly in front of opening Always have rubber boot on or close at hand
DECISIONS Decide what is ''stopped up''	**CUES** Fixture will not drain Fixture drains slowly Waste water overflowing	**ERRORS** Failure to clear stoppage Damage to fixtures

(TASK STATEMENT) LOCATE AND CLEAR STOPPAGE IN FIXTURES AND DRAINS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Examine area	Visual analysis, Describing, Detail/ Inference

(TASK STATEMENT) LOCATE AND CLEAR STOPPAGE IN WATER LINES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Special hand tools Water hose Length of steel rod Air compressor Pipe, fittings, valves Pipe cutting and threading tools	Disjoint lines Apply proper tools and/or equipment to clear stoppage Replace any damaged pipe and fittings Reconnect all lines	
DECISIONS Determine the extent of stoppage Decide if piping be replaced	**CUES** Water pressure at source No or little pressure at outlets	**ERRORS** Failure to clear stoppage Damage to piping

(TASK STATEMENT) LOCATE AND CLEAR STOPPAGE IN WATER LINES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Fluids under pressure	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Examine area	Visual analysis, Describing, Detail/ Inference

234

(TASK STATEMENT) REPAIR FAUCETS, BALL-COCK VALVES, FLUSHOMETER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Special hand tools Repair Kits ''Trinket'' box Replacement units, e.g. faucet, ball-cock valve, etc Manufacturer's instruction manuals	Shut-off supply to unit Visually examine unit Carefully disassemble unit per manufacturer instruction by accepted engineering practice Examine component parts for wear or defect Replace worn or defective parts Reassemble unit Turn on supply to unit, operate unit for test, make any necessary adjustments	

DECISIONS	CUES	ERRORS
Determine specific problem Determine if unit is repairable Determine if unit requires tools	Unit will not shut off Unit will not turn on Unusual sound Leaks Age of unit	Failure to accomplish repairs Damage to units

(TASK STATEMENT) REPAIR FAUCETS, BALL-COCK VALVES, FLUSHOMETER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure Forces acting on a body immersed or floatin~ in a liquid Inertia and momentum	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instructions	Comprehension, Detail/Inference, Recommendation reports, Description of mechanism
Viewing	Examine repair	Visual analysis, Describing, Detail/Inference, Recognition of symbols, codes, emblems

Duty M Testing of the Plumbing System

1 Rough-in test for drain, waste, and vent system
2 Run final test for drain, waste, and vent system
3 Test for the domestic water system

(TASK STATEMENT) ROUGH-IN TEST FOR DRAIN, WASTE, AND VENT SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Blocking and bracing material Sand and cement Lead working tool and equipment Water Test plugs Tie wire Air compressor Water hose Soldering tools and equipment Pressure gauge	Divide system in sections if testing a large building For water: Plug all openings except top of stacks Fill system with water to top of stack or to a point equal to a 10 foot head for 15 minutes For air: Plug all openings Fill system with air to a uniform pressure of five grams psi for 15 minutes Examine system for leaks and make necessary repairs Drain or purge system	Brace joints to prevent them from being pushed apart due to pressure

DECISIONS	CUES	ERRORS
Determine whether to sectionalize building **Determine whether to use water or air for test**	Size of building Number of stacks Availability of water Local codes	Test will not hold Installation will not pass inspection

(TASK STATEMENT) ROUGH-IN TEST FOR DRAIN, WASTE, AND VENT SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure Transfer of heat from one body to another Inertia and momentum Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Fundamental Operations (Calculation) "Measure sense"/role of "unit" Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instruction	Comprehension, Detail/Inference, Recommendational reports, Terminology

(TASK STATEMENT) RUN FINAL TEST FOR DRAIN, WASTE, AND VENT SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Lead working tools and equipment Soldering tools and equipment Test plugs Water hose Bucket Manometer Pressure gauge/inches of water Mercury gauge Test can	Divide system in sections if testing a large building Plug all openings Fill all traps with water Fill with air sufficient to maintain one inch water column for 15 minutes Remove test plug from one stack to be sure water column falls Examine system for leaks and make necessary repairs Remove all plugs	

DECISIONS	CUES	ERRORS
Determine whether to sectionalize building	Size of building Local codes	Test may not hold Installation will not pass inspection

(TASK STATEMENT) RUN FINAL TEST FOR DRAIN, WASTE, AND VENT SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure Transfer of heat from one body to another Inertia and momentum Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehending written instruction	Comprehension, Detail/Inference, Recommendational reports, Terminology

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(TASK STATEMENT) TEST FOR THE DOMESTIC WATER SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small hand tools Plugs and caps Pipe cutting and threading equipment Soldering tools and equipment Pressure gauge Potable water	Divide system in sections if testing a large building Examine installation for openings and close any openings Fill system with potable water to static pressure of 125 psi or not less than 10 percent in excess of normal operating pressure Examine system for leaks and make necessary repairs Drain and flush system Activate system to normal operating pressure	Water damage

DECISIONS	CUES	ERRORS
Determine whether to sectionalize building	Size of building Local codes	Test failure Installation will not pass inspection

(TASK STATEMENT) TEST FOR THE DOMESTIC WATER SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Fluids under pressure Transfer of heat from one body to another Inertia and momentum Effects of friction on work processes and product quality	Set of Real Numbers [Positive] Fundamental Operations (Calculation) ''Measure sense''/role of ''unit'' Instruments Measurement: geometric Linear

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehension of written instruction	Comprehension, Detail/Inference, Recommendational reports, Terminology

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